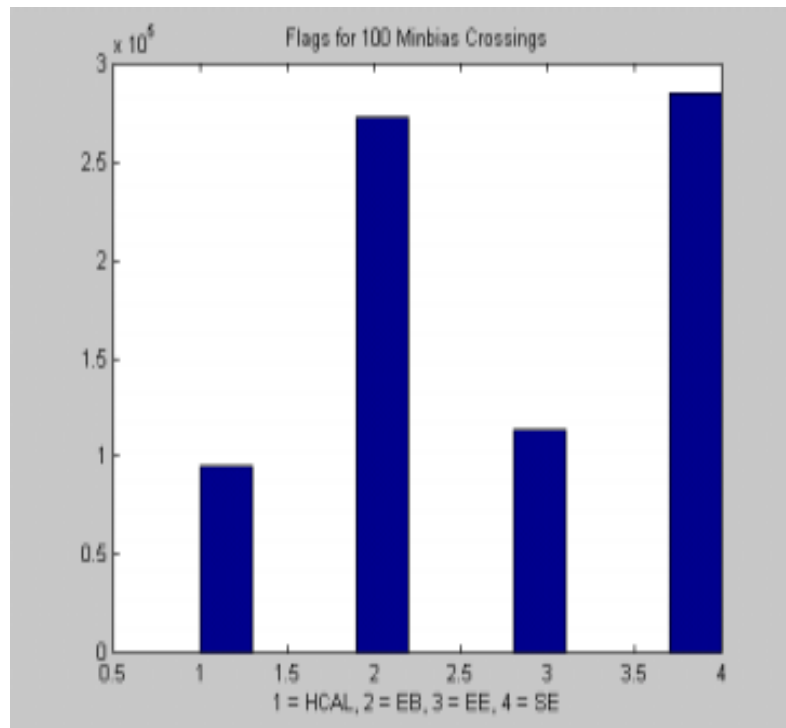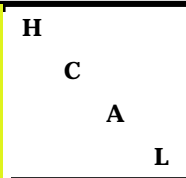# 100 Minbias - Hit Flags
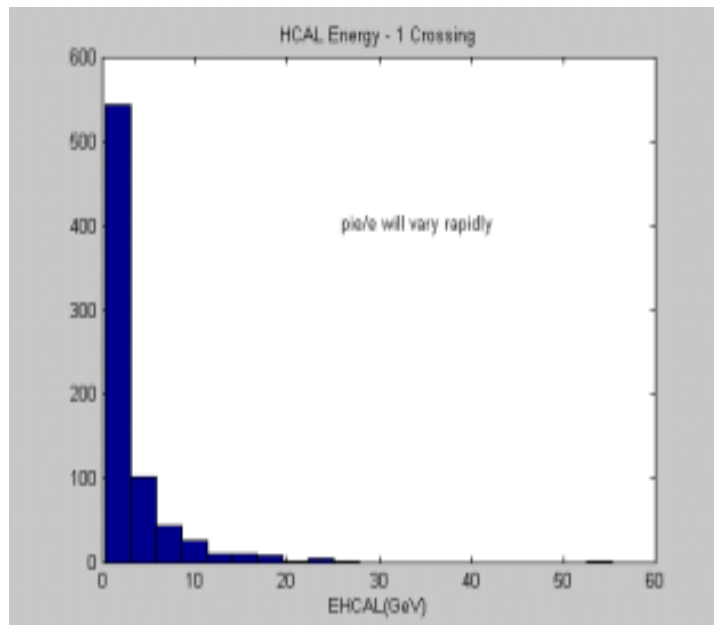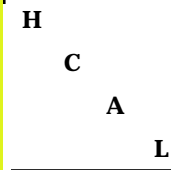
Flags for 100 Minbias Crossings

- **All "hits" are ~ 1000 in HCAL and ~ 7000 in ECAL for 1 crossing.**

- **Appears to be ECAL "noise". Set 0.1 GeV threshold in HCAL and ECAL.**
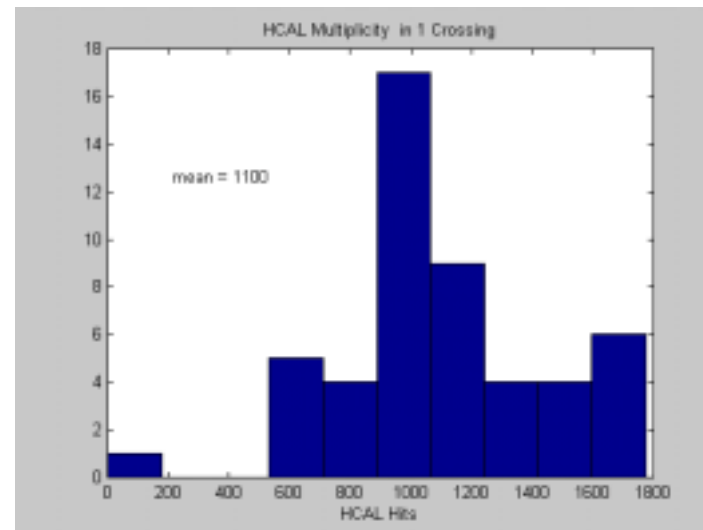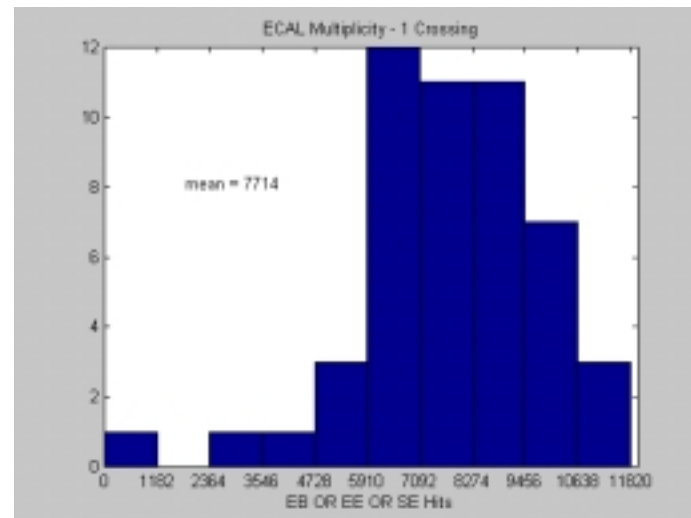
- **Hits after threshold are ~ 1600 ECAL and ~ 760 HCAL. Note that hits are sparse even at full luminosity.**

HCAL - ECAL # Hits

HCAL Energy - 1 Crossing

pio/e will vary rapidly

ECAL Multiplicity - 1 Crossing

mean = 7714

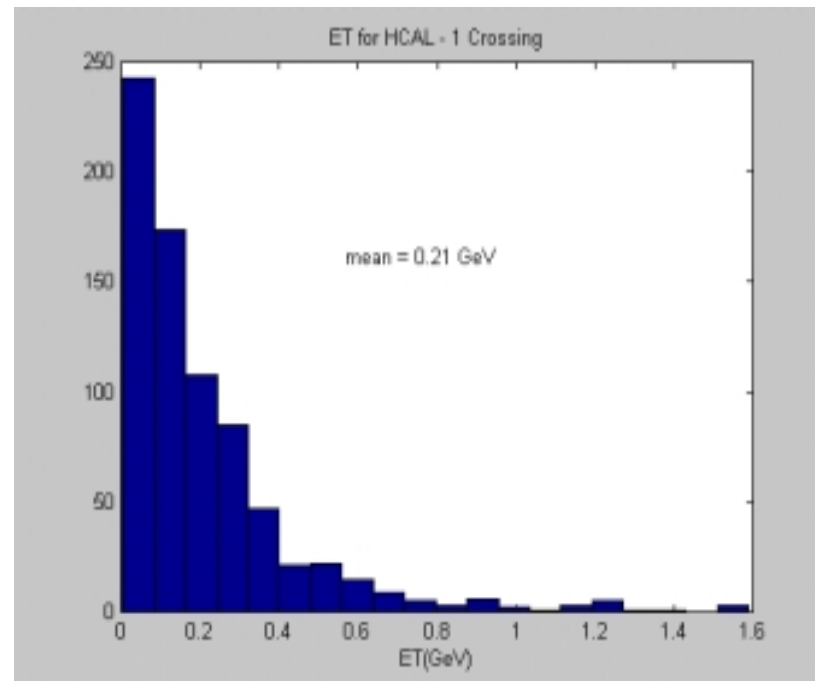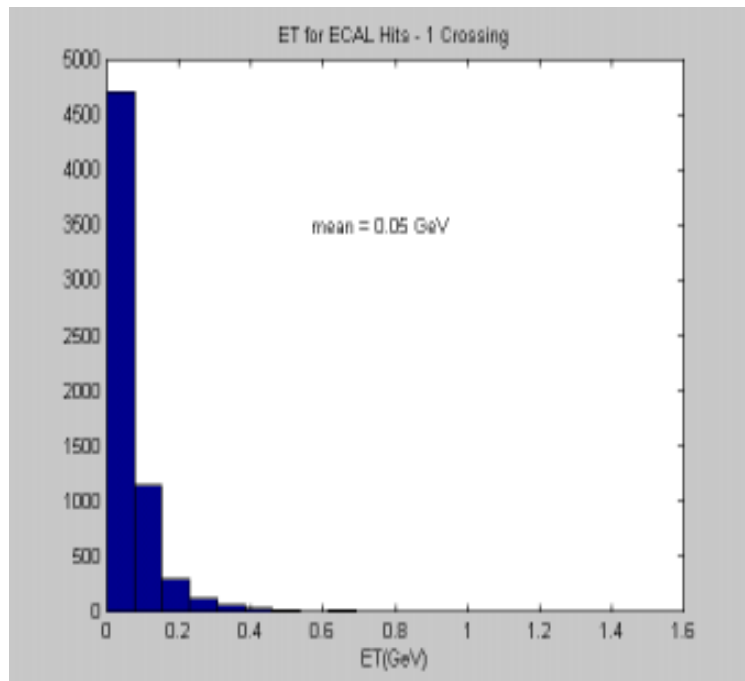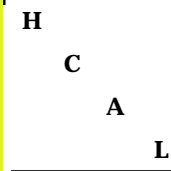HCAL Multiplicity in 1 Crossing

mean = 1100

Note that the energies are well below any that we have any test beam data on. This means we must get data in a low energy beam before taking data.
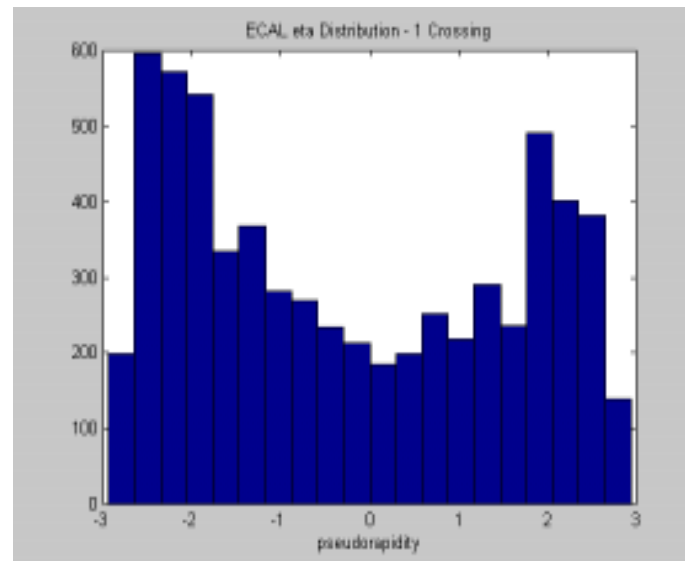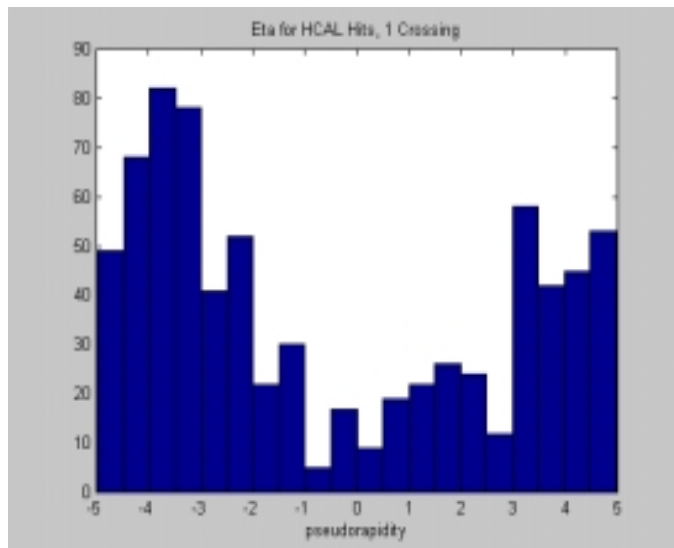
ECAL and HCAL - ET

ET for ECAL Hits - 1 Crossing

mean = 0.05 GeV

ET(GeV)

ET for HCAL - 1 Crossing

mean = 0.21 GeV

ET(GeV)

**"Hits" without threshold.
Note that ECAL has many
low Et "hits". HCAL looks
more reasonable.**

Eta for HCAL Hits, 1 Crossing

ECAL eta Distribution - 1 Crossing
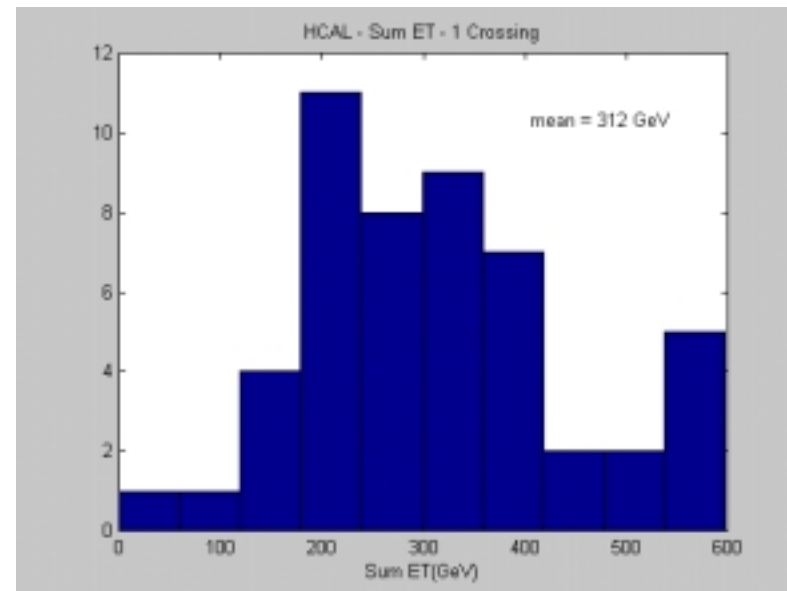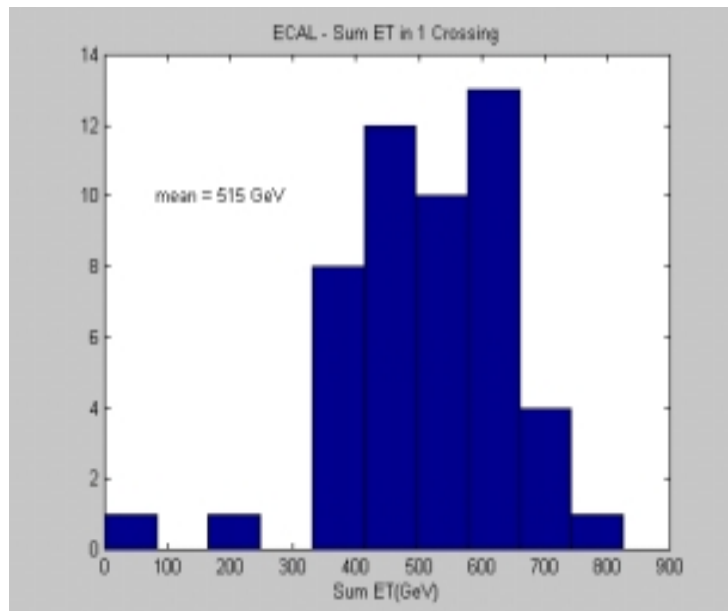
y distributions before threshold cut. After the cut HCAL still shows "sweeping", where the y ~ 0 region is depopulated by the B field. The low ET "hits" in ECAL appear in the endcap
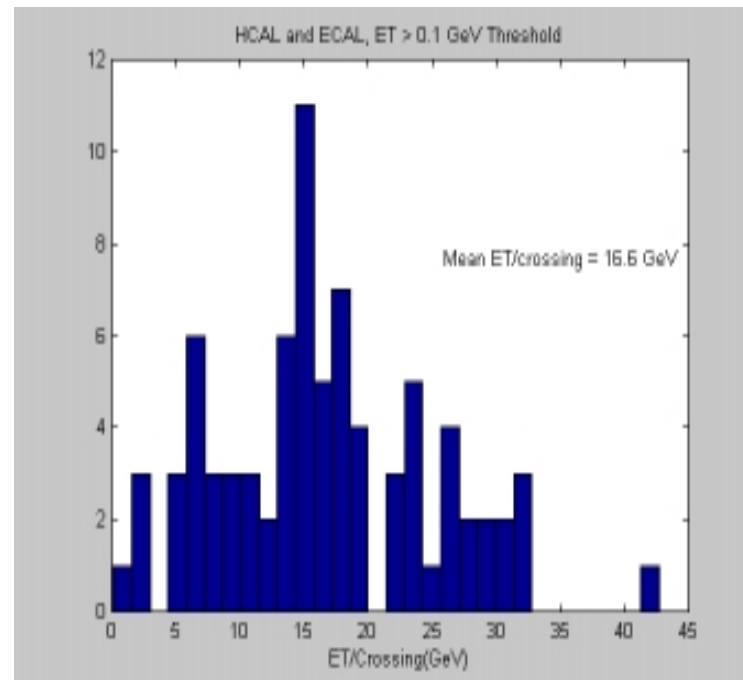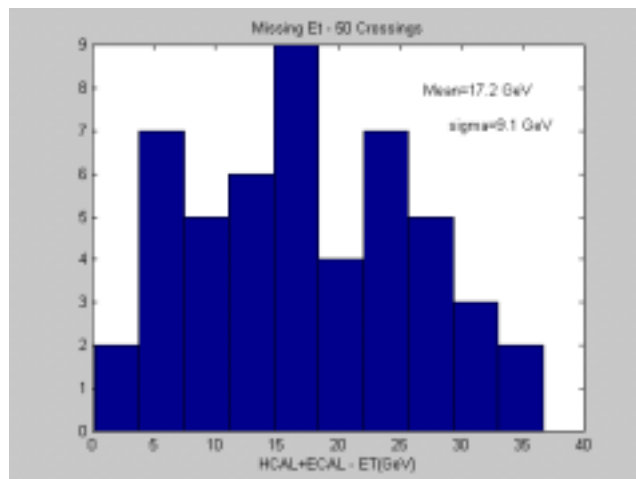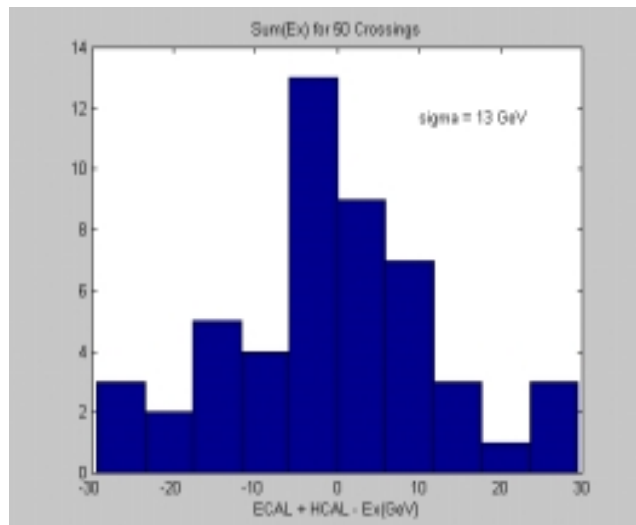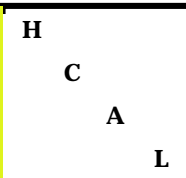

ECAL y after ET = 0.1 Threshold - 1 Crossing
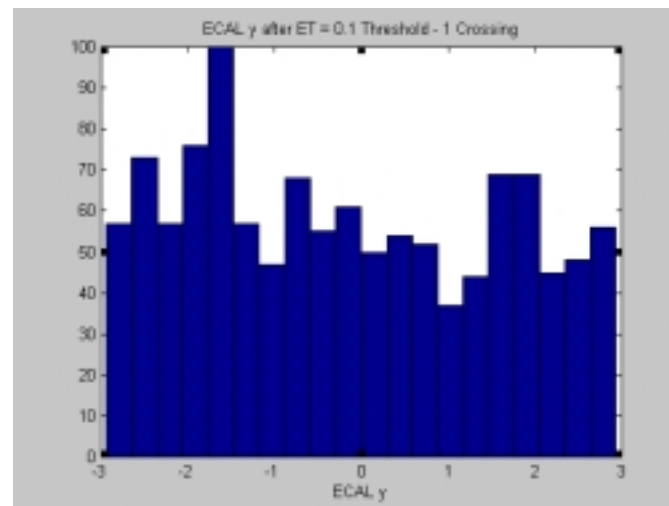
After threshold cut of 0.1 GeV, the mean ET in a crossing is 339 GeV in ECAL and 292 GeV in HCAL. Note HCAL is not changed much by the threshold cut, while ECAL is.

Sum(Ex) for 50 Crossings — sigma = 13 GeV, ECAL + HCAL - Ex(GeV)

Missing Et - 50 Crossings — Mean=17.2 GeV, sigma=9.1 GeV, HCAL+ECAL - ET(GeV)

HCAL and ECAL, ET > 0.1 GeV Threshold — Mean ET/crossing = 16.6 GeV, ET/Crossing(GeV)

After the threshold cut the missing ET, or <ET> in 1 crossing is 16.6 GeV, so little change is made by the threshold cut.

Clustering in HCAL, ECAL
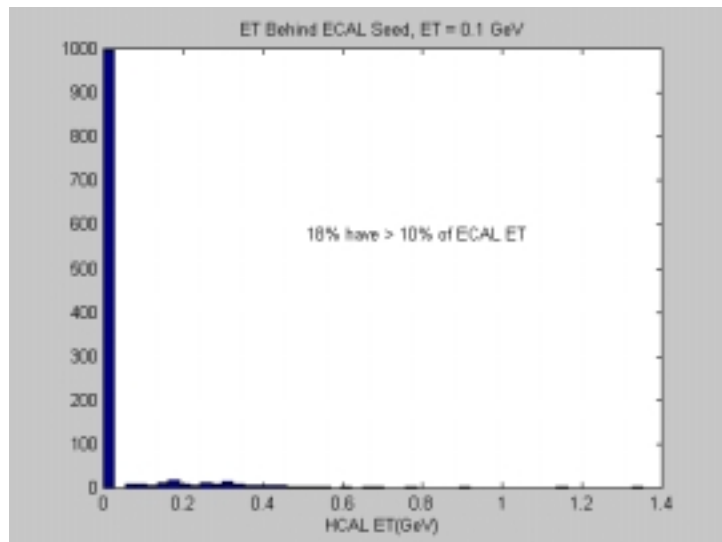
HCAL Clusters - R < 0.2

mean = 2.1, <ETc> = 0.62 GeV

Nhits in Cluster

ECAL Clusters - Seed ET > 0.25 GeV

mean = 2.2

N cluster - ET > 0.05 GeV, R < 0.05
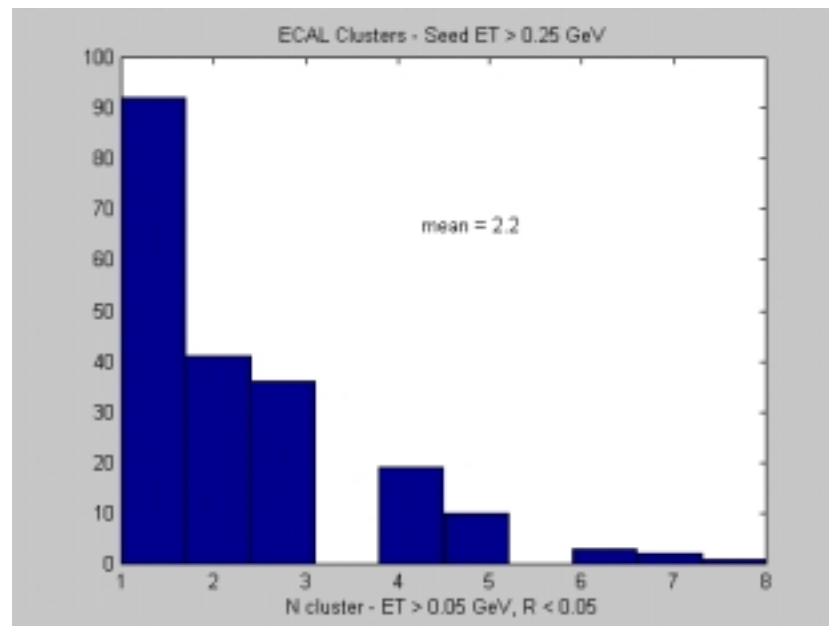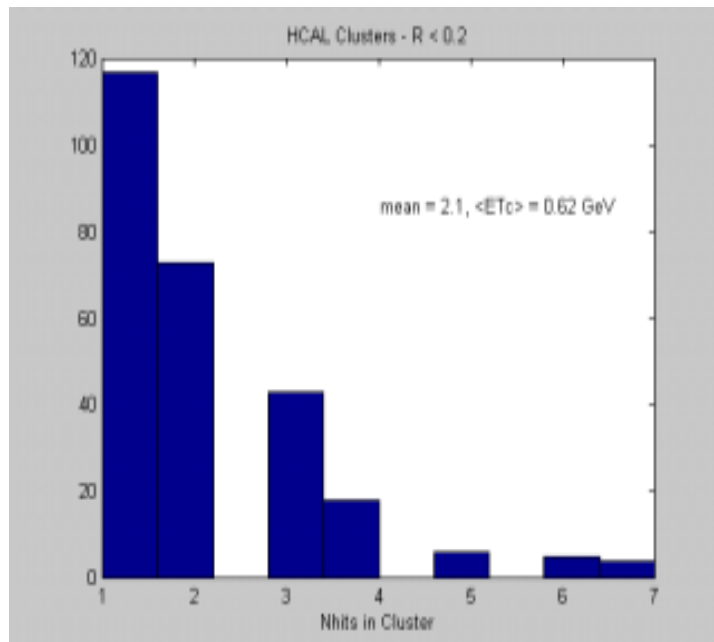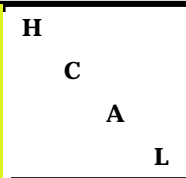
Since data is sparse, we can cluster "seeds" ordered in ET. For ECAL with seed ET > 0.25 GeV, R < 0.05 (~ 5 x 5 in ECAL) clusters are attached as are those in HCAL for R < 0.2 (~ 3 x 3).

Et Weighted Mean R of ECAL Cluster

Mean ET = 0.39 GeV, Mean Cluster Mult = 2.0

ECAL Clusters for Seed ET = 0.15 geV

Mean Cluster Mult = 2.0
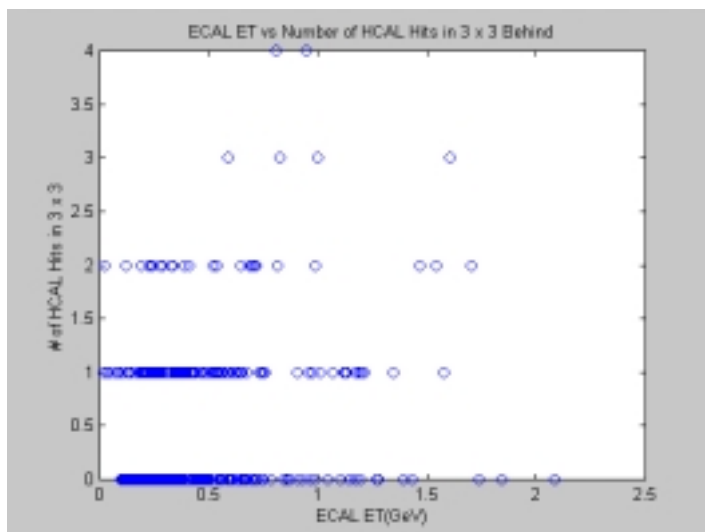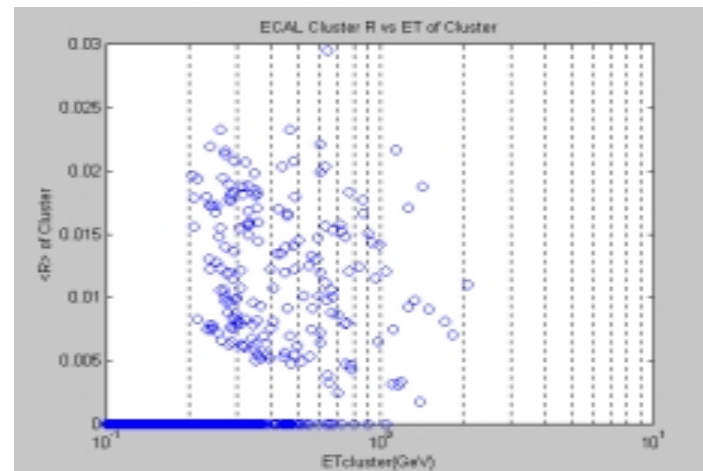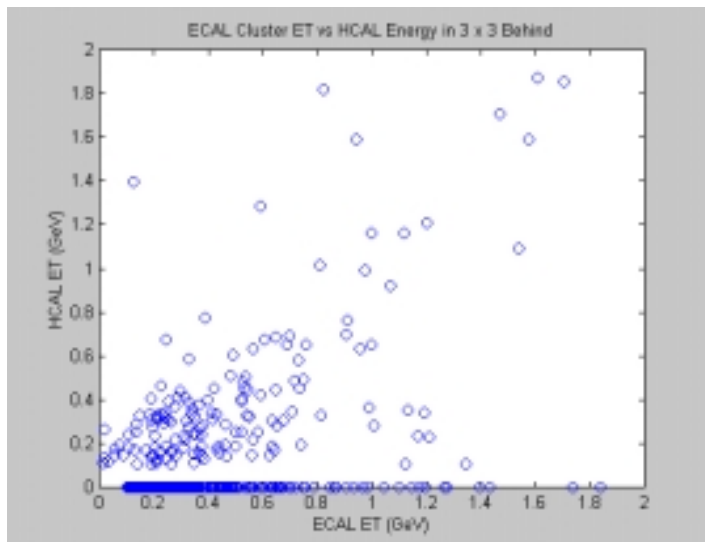

ET Behind ECAL Seed, ET = 0.1 GeV

18% have > 10% of ECAL ET
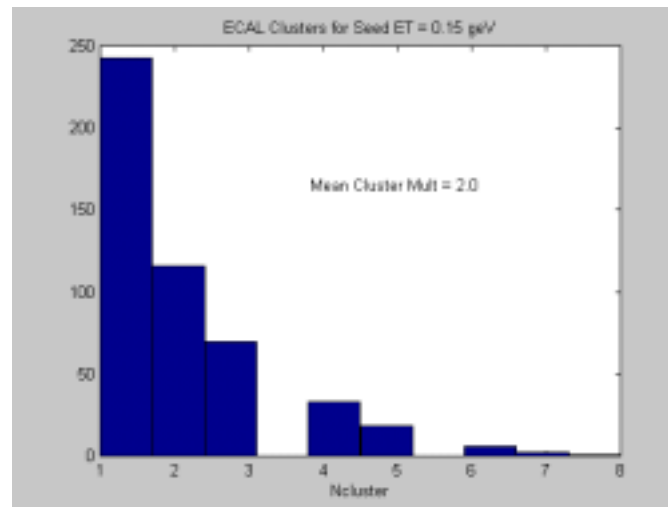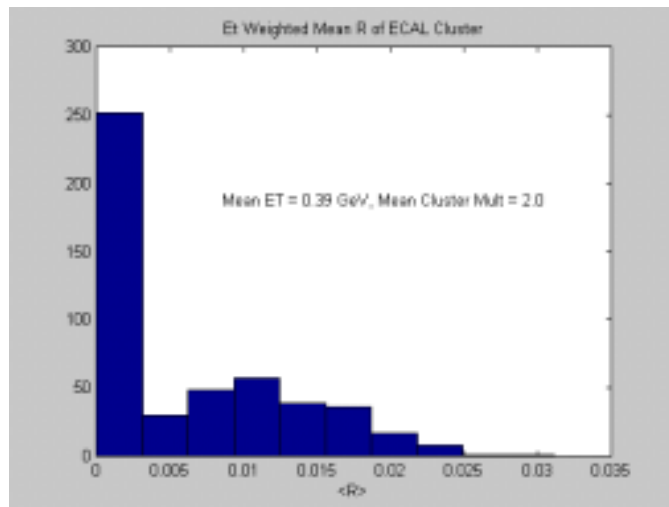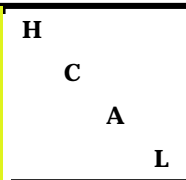
In ECAL there are "hits" which cluster (R > 0) and "hits" which do not (R =0). There are also hits with HCAL energy behind them and those which do not have matching HCAL energy.
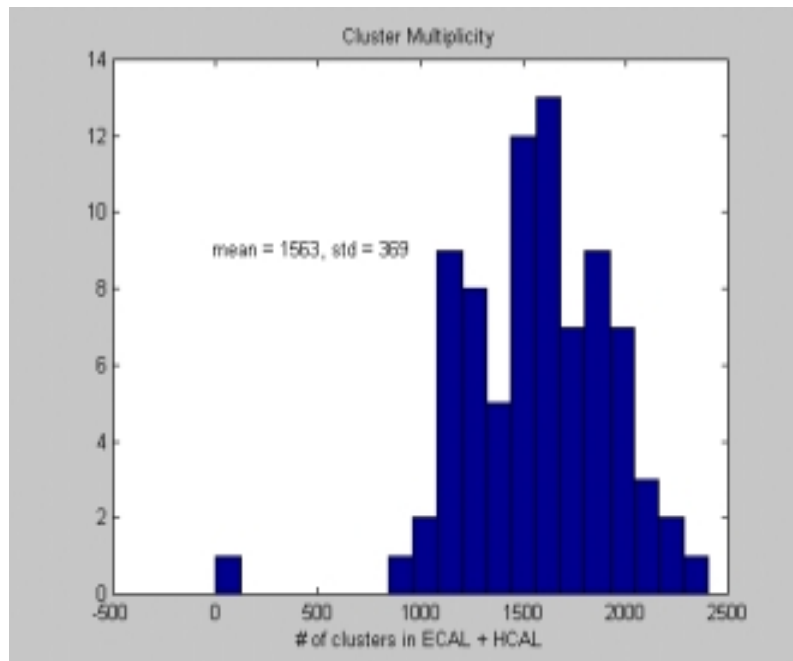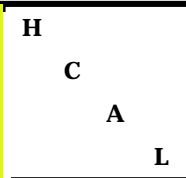
What are the 2 ECAL Types?

ECAL Cluster ET vs HCAL Energy in 3 x 3 Behind

ECAL Cluster R vs ET of Cluster

ECAL ET vs Number of HCAL Hits in 3 x 3 Behind

By definition in ECAL low R <--> low ET. The low ET also appear to have few matching hits in HCAL and little matching energy in HCAL. Thus, it appears the single ECAL "hits" are not charged hadrons.

Calorimeter Clustering

- **Take all ECAL hits with ET > 0.1 GeV as seeds. Cluster them in ECAL if R < 0.05 (~ 5 x 5). The look in a ~ 3 x 3 of HCAL (R < 0.15) behind this seed. If the sum of HCAL is > 10% of ECAL call it type 1, if not it is type 0.**

- **Then in HCAL take all remaining hits as seeds and cluster in a ~ 3 x 3, R < 0.15. These are type 2**

- **In principle, correct type 1 and type 2 by e/pie for these low energy hadrons.**

Minbias Expectations
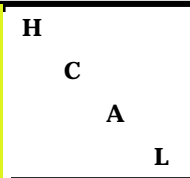
- **We expect a mean ET of ~ 0.5 GeV with a charged particle density of ~ 6. For 15 events/crossing we expect 450 GeV (900 hits) in HCAL (10 units of y) and 145 GeV (300 hits) in ECAL (6 units of y).**

- **The clustering output has mean sum ET of ~ 630 GeV, 1560 clusters/crossing. The ECAL type 0 clusters are 245 GeV, and 390 GeV for type 1 and 2. The HCAL ET is ~ 240 GeV in HB and HE and then 150 GeV in HF. This partition in HCAL is roughly in the ratio of the rapidity ranges.**
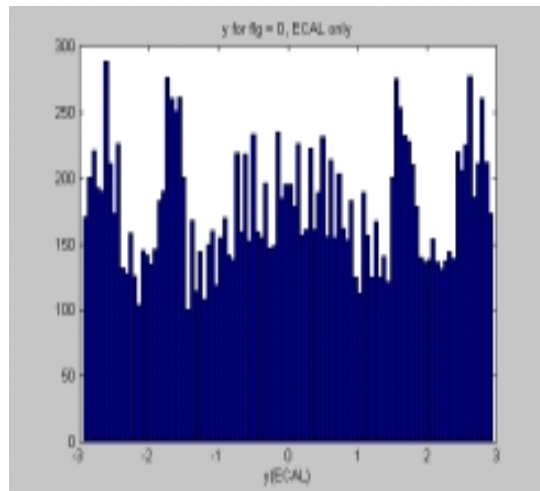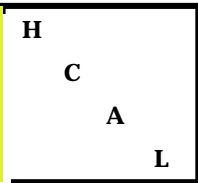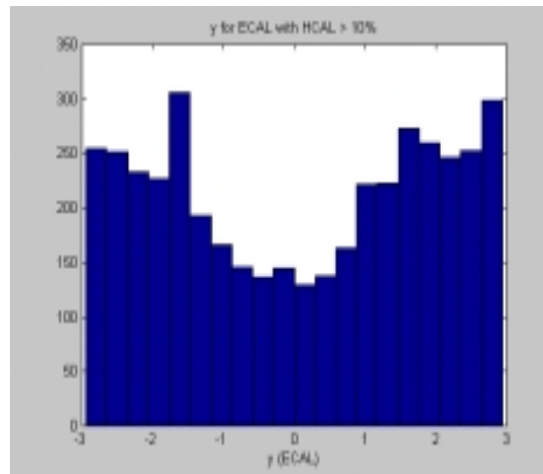
Single Particle e/π
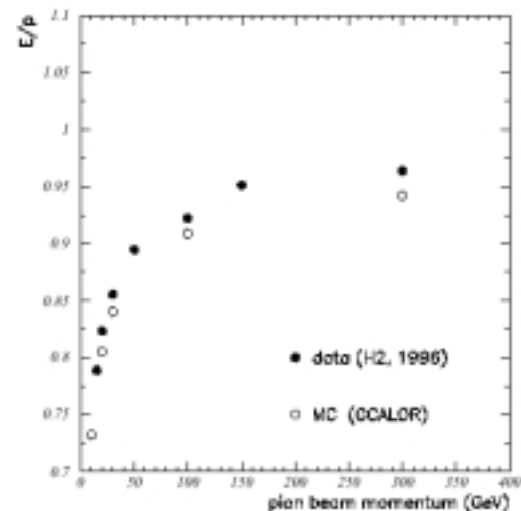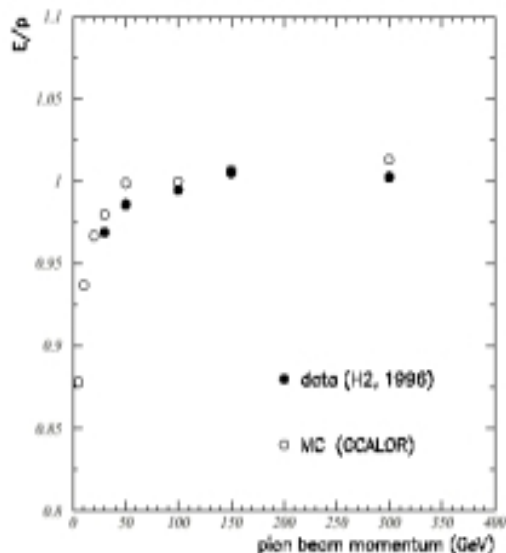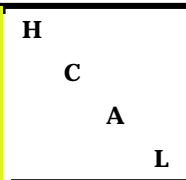
The corrections for interactions (left hand) in HCAL (type 2) and interactions in ECAL (right hand) - type 1 are large. Note, page 2, that the mean energy is ~ 1 GeV, so that 50% corrections are possible. They may be swamped by energy resolutions of 100%.

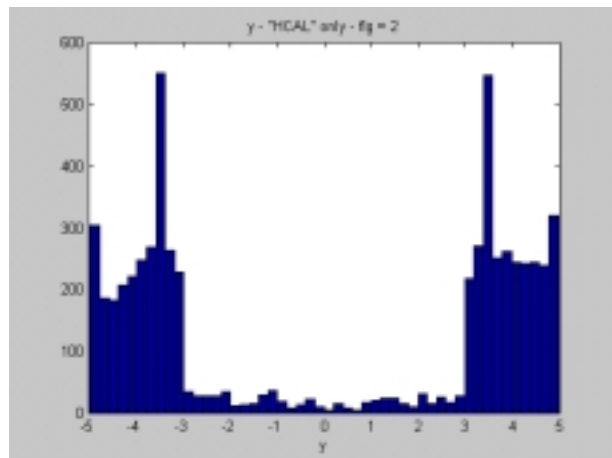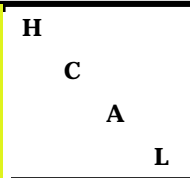# **Cluster Flags and y**

ECAL alone - see EB/EE

ECAL with HCAL behind

B Sweeping?

"HCAL" only - confined to HF

Cluster Types

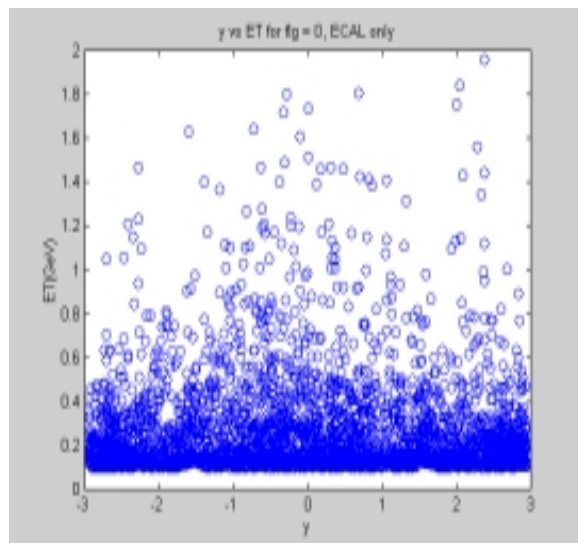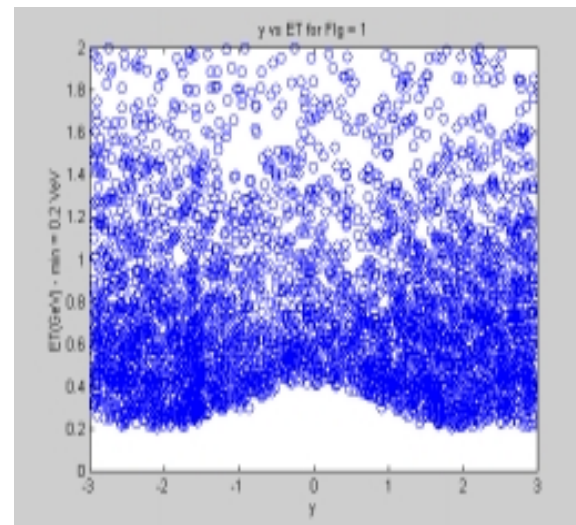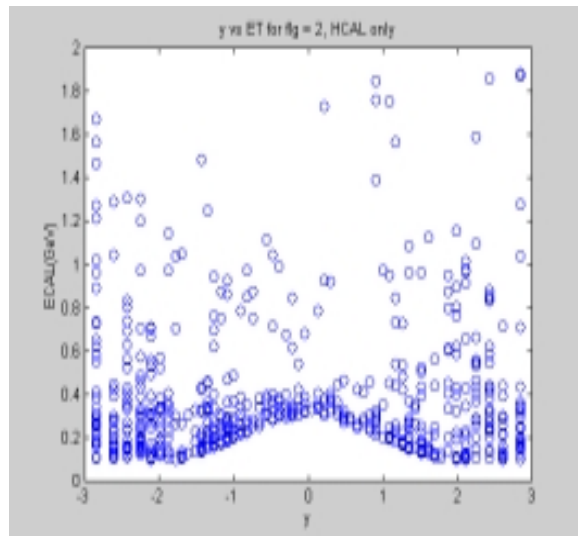<ET> = 0.24 GeV,   0.9 GeV,   0.46 GeV

 <n> = 1.27   2.76   1.26

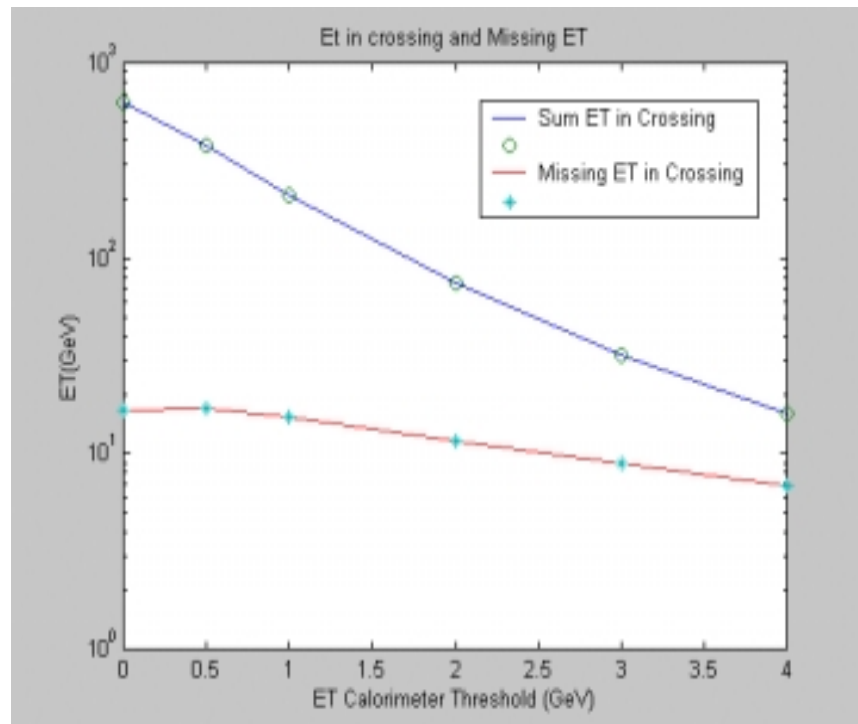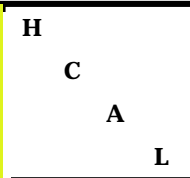 63%   15%   22%

sumET = 218GeV   219 GeV 161 GeV

For flg = 1 and 2 - charged hadron interacting in ECAL or in HCAL see "sweeping". Expect ET ~ 0.8 to reach ECAL, ~ 1.2 GeV to reach HCAL.

Note Et> 0.1 for flg =2 and ET > 0.2 for flg = 1

For flg = 0, we see no "sweeping" ==> clustering particle I.d. has some validity.

Thresholds, Calibrations?

Et in crossing and Missing ET

There is no particular gain in imposing a cluster threshold. The missing ET goes down, but only with considerable loss of information.

Calibrations made to flg = 1 and flg = 2 to correct for pie/e , if anything, make the mssing Et worse by raising the level of energy.